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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/802,428
Filing Date: March 17, 2004
Appellant(s): ZHANG ET AL.

Dan C. Hu
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 25 March 2011 appealing from the Office action mailed 27 October 2010.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The following is a list of claims that are rejected and pending in the application:

Claims 1–3, 5, 7–15, 17, and 19–25[1].

(4) Status of Amendments After Final

The examiner has no comment on the appellant's statement of the status of amendments after final rejection contained in the brief.

(5) Summary of Claimed Subject Matter

The examiner has no comment on the summary of claimed subject matter contained in the brief.

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[1] Appellant states in pages 2 and "i" that claims "26–29" have been cancelled. Claim 30 is also cancelled.

(6) Grounds of Rejection to be Reviewed on Appeal

The examiner has no comment on the appellant's statement of the grounds of rejection to be reviewed on appeal. Every ground of rejection set forth in the Office action from which the appeal is taken (as modified by any advisory actions) is being maintained by the examiner except for the grounds of rejection (if any) listed under the subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION".

(7) Claims Appendix

The examiner has no comment on the copy of the appealed claims contained in the Appendix to the appellant's brief.

(8) Evidence Relied Upon

- P. De Smet & D. De Vleeschauwer, "Motion-Based Segmentation using a thresholded merging strategy on watershed segments", 2 Proc. 1997 Int'l Conf. on Image Processing (ICIP `97) pp. 490-493 (Oct. 1997).
- B. Zhang, "*K*-Harmonic Means – A Data Clustering Algorithm", Hewlett-Packard Laboratories Technical Report 1999-124 (Oct. 1999).
- S. Herrman, H. Mooshofer, H. Dietrich, & W. Stechele, "a Video Segmentation Algorithm for Hierarchical Object Represenations and Its

Implementation", 9 IEEE Trans. on Circuits & Sys. for Video Tech. 1204--1215 (Dec. 1999).

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1–3, 5, 7, 10–15, 17, 19, and 22–25 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Motion-based Segmentation Using a Thresholded Merging Strategy on Watershed Segments" ("de Smet") in view of "K-Harmonic Means–A Data Clustering Algorithm" ("Zhang"). De Smet discloses using an iterative segment-merging technique to determine information for an image (abstract).

Regarding claims 1, 13, and 25, in de Smet, an initial motion field is first determined with a block-matching technique on 4 x 4 blocks. De Smet, § 2.1. These initial block motion vectors are used for the initial segmentation. *Id.* at § 2.3.

Then, the step of performing the block-based motion estimation is the claimed step of "providing data points", and the motion vectors themselves in the initial motion field are the claimed "motion paths". Next, the segments are iteratively merged according to similar or shared motion, according to the K-means clustering algorithm. Id. This is the claimed step of "cluster[ing] the data points". When this process is finished, the result is a series of large segments corresponding to distinct moving regions of an image, each with an associated motion vector. Id. This is the claimed step of "providing motion estimation". However, the present invention specifies performing regression clustering according to a K-Harmonic Means function, which is not the same as the K-means function of de Smet.

Zhang discloses the K-Harmonic Means data clustering algorithm. Regarding claim 1, 3, and 25, Zhang teaches selecting K centers m(l) from N data points x(i) (pg. 1), initializing center points (pg. 2) and performing an initial iteration (pg. 5), and calculating distance d(i,l) between data point x(i) and center point m(l) (pg. 4), calculating membership probability p(i,x) based on the distance via parameters q(i,k) and q(i) (pg. 5), and stopping when the recursively-calculated performance value stabilizes, that is, when its change with each iteration becomes small (pg. 5). Then, the K calculations of centers m(l) are the claimed "regression functions" for performing regression clustering according to the K-harmonic means function. The calculation of each iteration of the recursive function is the claimed recalculation based on the membership probability, as m(k) is dependent on

probability function p(i,k). The stabilization is the claimed "stopping criterion". In the particular application of "data compression and vector quantization", these center points are the claimed "motion paths" or motion vectors of de Smet, and distance d(i,l) is the claimed "error".

De Smet discloses the claimed invention, except for using K-Harmonic Means function to perform regression clustering. Zhang teaches that it was known to perform data clustering with the K-Harmonic means function. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to perform clustering based on a K-Harmonic means function, as taught by Zhang, rather than a linear function such as the K-means function of de Smet, since Zhang states in the abstract that K-harmonic clustering is less sensitive to detrimental effects from sub-optimal initialization than conventional clustering techniques. Additionally, the K-harmonic means function was specifically designed as an improved version of the K-means function, which "significantly improves the quality of clustering results" compared with K-means (abstract). Then, the de Smet algorithm contains a basic method that the present invention is an improvement thereof. The prior art Zhang describes a known technique, the K-Harmonic means clustering algorithm, applicable to the base segmentation method of de Smet, by substituting it for the K-means algorithm. Then, one having ordinary skill in the art would have recognized that applying the K-harmonic means algorithm of Zhang to de Smet would have yielded the predictable result of "significantly [improved]

quality of clustering results" and resulted in an improved system. Therefore, it is respectfully submitted that the use of K-harmonic clustering in de Smet is considered obvious, since it has been held that applying a known technique to a known method ready for improvement to yield predictable results involves only routine skill in the art. Dann v. Johnston, 425 U.S. 219, 230, 189 U.S.P.Q. 257, 261 (1976); In re Nillsen, 851 F.2d 1401, 1403, 7 U.S.P.Q.2d 1500, 1502 (Fed. Cir. 1988).

Regarding Claims 2, 3, 14, and 15, as previously mentioned, de Smet produces a motion vector for each segment in an image. De Smet, § 2.3. As a result, the most important moving areas are determined. Id. at § 3. This is the claimed production of motion vectors and at least one motion path.

Regarding Claims 5 and 17, in Zhang, a clustering in which initialization is randomized is described (pg. 11). Since Applicant admits in page 10 of the 19 January 2010 Appeal Brief that this initialization is an initialization of the algorithm as a whole, it inherently contains an initialization of the regression function.

Regarding Claims 7 and 19, insensitivity to initialization is an inherent result of the K-Harmonic Means algorithm. Zhang, abstract.

Regarding Claims 10 and 12, in de Smet, pixels are set as (x, y, t) triples, with x and y as spatial coordinates and t as a time coordinate. De Smet, § 2.2.

Regarding Claims 11 and 23, de Smet illustrates motion fields. De Smet, figs. 3–6. Although these motion fields are not shown as overlaid on the images, the examiner takes Official Notice that it was well-known in the art at the time of the invention to display a motion field superimposed on an image to provide a visual representation of motion vectors.

Regarding Claims 12 and 24, de Smet illustrates highlighted motion segments overlaid on an image. De Smet, figs. 11, 12.

3. Claims 8, 9, 20, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over de Smet in view of Zhang as applied to claims 1 and 13 above, and further in view of "A Video Segmentation Algorithm for Hierarchical Object Representations and its Implementation" (Hermann). Claims 8, 9, 20, and 21 disclose using color information to segment techniques, but de Smet only discloses "standard watershed techniques" to perform initial segmentation without providing details. De Smet, § 2.2.

Hermann discloses a method for image segmentation to extract objects from a moving image. Regarding Claim 8, 9, 20, and 21, after an initial block-matching motion estimation, similar to that in de Smet, images are segmented according to specific color information, followed by shape analysis, and lastly motion analysis to merge regions to determine objects. Herrmann, § II. This color, shape, and motion information form the claimed "predetermined criteria". In color analysis, a region is

determined as homogeneous if the pixel difference in the region is below a threshold. Homogenous, connected areas are determined as "quasi-flat zones". These quasi-flat zones are further processed and become the basis for further segmentation. Id. at § II.B. Then, the color analysis is the claimed step of "portioning data according to color".

De Smet, in combination with Zhang, disclose a majority of the features of claims 8, 9, 20, and 21 of the claimed invention, as discussed above, except for color segmentation. Herrmann teaches that it was known to segment a moving image according to color. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to determine image segmentation by color as taught by Herrmann, since Herrmann teaches in p. 205, ¶ 3, that color analysis produces the most accurate type of segmentation.

(10) Response to Argument

At issue is whether 35 U.S.C. §§ 102(b) and 103(a) place a statutory bar and loss of patent rights to an inventor who files a patent application for a specific use of a discovered algorithm more than one year after publishing a paper that describes the algorithm and contemplates the claimed specific use.

In October 1999, assignee Hewlett-Packard Co. published "K-Harmonic Means – A Data Clustering Algorithm" (the "Zhang" reference), authored by Appellant Bin Zhang and two others. This paper proposes a K-Harmonic Means

algorithm described as "a center-based clustering algorithm which uses the Harmonic Averages of the distances from each data point to the centers as components to its performance function". Zhang, abstract. This K-Harmonic Means algorithm is designed to improve on a noted fault with a clustering algorithm called K-Means algorithm: the K-Means algorithm is dependent on well-placed initializations of centers of the different data clusters -- the initialized centers, if placed poorly, can take a long time, if not indefinitely, to resolve themselves to actual centers of data clusters. The K-Harmonic Means algorithm eliminates this fault, yielding rapid convergence of the initialized centers to data clusters, even if the centers were poorly placed. Id.

The Zhang reference describes various applications for clustering techniques like K-Means and K-Harmonic Means, such as data mining, statistical data analysis, and "data compression and vector quantization". Zhang at § 1. The third stated application of clustering, data compression and vector quantization, is described with respect to the older K-Means algorithm in the de Smet reference, which describes performing the K-Means algorithm to segment digital images based on a motion vector field.

The present application is directed toward systems for "performing regression clustering using a K-Harmonic Means function to cluster the data points [in an image sequence] and to provide motion information regarding the data points" as a way to "estimat[e] motion trials in video image sequences". The three independent

claims, 1, 13, and 25 disclose, respectively, a data medium storing executable instructions to perform the K-Harmonic Means function, a machine that performs the K-Harmonic Means function, and a method of performing the K-Harmonic Means function. This application was filed on March 17, 2004, nearly 4 1/2 years after the Appellant's initial publication disclosing how to perform the K-Harmonic Means function.

During prosecution, the examiner rejected the claimed invention over a combination of the de Smet K-Means image data segmentation and the Zhang K-Harmonic Means algorithm, with the rationale for substituting the K-Harmonic Means algorithm for the K-Means algorithm to take advantage of the known improvements described in the Zhang reference of using the K-Harmonic Means algorithm over the K-Means algorithm. To the examiner's recollection, Appellant has not disclaimed that the K-Harmonic Means algorithm is somehow uniquely not suited as an improvement over the K-Means algorithm for the specific claimed application of image data segmentation.

35 U.S.C. § 102 "deals with the two questions of 'novelty' and loss of right". In re Bass, 177 U.S.P.Q. 178, 189 (C.C.P.A. 1973). Of the seven sections of § 102, the four "prior art" sections, (a), (b), (e), and (g) have relation to § 103 and relevancy to "prior art" under § 103. Id. Analysis of the relations between §§ 102(b) and § 103 includes recalling that Congress placed § 102(b) "as a sort of statute of limitation . . . within which an inventor, even though he has made a patentable invention, must

act on penalty of loss of right to his patent." In re Foster, 145 U.S.P.Q. 166, 173 (C.C.P.A. 1965). The one year period starts running based on the availability of the invention to the public through the categories of disclosure enumerated in 102(b), which include a 'printed publication' anywhere describing the invention". Id. While the Foster court recognized that "there appears to be no dispute" that a single "printed publication" made publically available over a year causes a loss of patent rights to any invention described in that publication (Id.), the court asked how this analysis relates to the question of whether such a publication renders its contents obvious to one of ordinary skill in the relevant art. Id. Reading that the phrase "a printed publication" in 102(b) can be interpreted both in the singular and the plural, and considering the intent of Congress to make §102(b) a "time-bar" that predicates a loss of right, the Foster court concluded that the § 102(b) loss of rights not only includes cases of anticipated inventions, but also cases of obvious inventions. Id. at 173–174. As such, the loss of rights under § 102(b) analyzed *at the time of filing* supercedes the requirement of § 103 obviousness analyzed *at the time the invention was made*. Id. at 174 (emphasis added).

In this case, Appellant published a disclosure of "the K-Harmonic Means algorithm" in October 1999, and then in March 2004 filed a patent application containing, in the body of each independent claim, instructions for performing "a K-Harmonic Means" function in the context of clustering image data. Appellant, however, does not consider his 1999 K-Harmonic Means publication a barrier of

patentability to his 2004 K-Harmonic Means application, but alleges that the examiner's mapping of the two identically-named algorithms in the context of image data clustering contains "several fundamental incorrect assertions". Appeal Brief at pg. 8.

Appellant first alleges that the examiner was incorrect in equating the de Smet "difference or distance between motion vectors" and the claimed "error". Appellant discusses the motion vectors of de Smet, arguing that in that reference, "a difference or distance between motion vectors refers to a difference or distance between motion vectors for corresponding multiple segments of an image". Appellant then states that in the examiner's position that the de Smet motion vectors in a motion field are the claimed "motion paths" is erroneous since the claimed invention does not disclose calculating differences or distances between motion paths but between "data points and corresponding K regression functions estimating motion paths". However, first, Applicant does not address why "the errors between data points and corresponding ones of the K regression functions estimating motion paths" are not or cannot be "motion vectors" in a motion field. Appellant's argument that the distance or difference between motion vectors in de Smet would represent a distance or difference between motion paths as claimed is irrelevant — as Appellant admits in pg. 9 of the Appeal brief, claim 1 is not directed to calculating a difference or distance between motion paths, but errors between data points and **corresponding** points of the K regression functions, to estimate

these motion paths. The Claim 1 rejection did not discuss differences or distances between motion vectors[2], but rather the distance d(i,l) between data point x(i) and corresponding center point m(l) in the Zhang reference.

Appellant further alleges that the center points of Zhang are not equivalent to "the endpoints of the motion vectors" in de Smet or the claimed "motion paths". Applicant argues that if the endpoints of Zhang are geometric center positions of respective clusters of data points, they cannot be the de Smet motion vector endpoints, since "Zhang has nothing to do with providing motion information regarding center points". While this may be true for Zhang itself, the rejection is not made solely on the Zhang reference, but in a combination between the Zhang reference, mainly directed to an abstract algorithm, and de Smet, which discloses the use of this type of algorithm in image analysis based on motion vectors. Appellant has not shown that the Zhang algorithm is not applicable to image data clustering, when the Zhang algorithm is specifically described as being designed as an improvement over the K-Means algorithm used for image data clustering in the de Smet reference.

Appellant has not proven that what he meant by "K-Harmonic Means" in October 1999 and what he meant by "K-Harmonic Means" in March 2004 are so

[2] Applicant relies on the "Response to Arguments" section of the Final Rejection, which described "a difference or distance between motion vectors" as "the claimed 'error'". While Applicant has shown that this alternative claim interpretation is faulty, Applicant has not addressed the discussion in the claim rejection itself that in the Zhang distance between a data point and a corresponding center point in a cluster is patentably distinct between the claimed "error" between a data point and a corresponding point in a K-regression function.

different as to make the algorithm described by the newer use of this label patentably distinct over the older use of this label. Considering the above, the October 1999 Zhang reference, in combination with the de Smet reference that presents a ready use for the K-Harmonic Means algorithm, **is a statutory bar** to the patentability of the claimed application filed in March 2004.

Appellant in page 11 of the appeal brief alleges that the rejection of claim 5 was in error since the Zhang reference does not disclose the claimed random initialization of regression functions. However, Zhang in page 11 describes an experiment in comparing the performance of the claimed K-Harmonic Means algorithm with prior art algorithms, in which each algorithm starts 'from the same random initialization". Page 14 illustrates the results with the two prior art algorithms and page 15 illustrates the results with the claimed K-Harmonic Means algorithm.

Appellant in pages 11 and 12 presents *pro forma* arguments on claims 13 and 25 as parallel in scope to claim 1 and claim 17 as parallel in scope to claim 5. The examiner will, likewise, not repeat the above arguments with respect to these claims, but only note their applicability as directed to material parallel in scope with the claims discussed at length in this brief.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For at least the above reasons, all claim rejections should be sustained.

Respectfully submitted,

/D. N. W./

Examiner, Art Unit 2483

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